

The authors identify the new literacies of this technological age and explore a variety of tools available to teachers.

Becoming literate in the technological age: New responsibilities and tools for teachers

Consider the following two scenarios (both teachers' names are pseudonyms):

Ms. Jones's first-grade students have been using computers to improve their spelling skills. Through the process of reading trade books, students keep a word bank containing the words with which they are unfamiliar. When in the computer lab, they use an electronic dictionary to look up the meaning of these words, which they enter into their word banks. Ms. Jones collects the students' word banks once a week and develops spelling and definition multiple-choice worksheets using her class computer. She prints out these worksheets and gives them to her students to complete during the language arts period.

Ms. Doyle is a second-grade teacher working in a bilingual classroom. She received digital cameras and video recorders through a curriculum grant and, with her students, has used them to interview bilingual business owners in the community surrounding their culturally diverse urban school. The purpose underlying the interviews was to discover insights on the question "What does it mean to be bilingual?" Ms. Doyle based the activities for this curriculum project around city and state standards in language arts, social studies, and technology. Together students wrote interview questions; practiced them on one another; took walking field trips into the community; and, armed with digital cameras, video cameras, and audiotapes, accomplished the interviews. Upon returning to their classroom, they reviewed their pictures, audiotapes, and videotapes and then used the five classroom computers to analyze and synthesize their information for a digital slide show, which they shared with their school community. They also e-mailed these slide shows to "e-pals" with whom they had been communicating.

A paradigm shift in literacy instruction

In both of these scenarios, the importance of teaching students to read and write in print remains an essential goal, yet in each the vision for doing so is different—each teacher's approach to instruction, as well as her use of technology, differs.

In the first scenario, Ms. Jones's notion of literacy is text based, and she is using a skill-building approach to develop her students' reading and writing abilities. In doing so, Ms. Jones lays out specific, directed tasks for her students to complete. These text-based tasks target students' acquisition of spelling and vocabulary skills. Ms. Jones's use of technology stems from this skill-based approach to literacy instruction: Technologies are used for isolated skill development. Ms. Jones layered technologies on top of her established traditional curriculum and is merely replicating what is usually done with books and paper. As such, technology becomes nothing more than an electronic version of the classic student worksheet. Children accessed technology in much the same way that they engaged in individual seatwork.

The second scenario exemplifies a different, broader vision of literacy instruction. While Ms. Doyle's students are engaged in text-based literacy instruction, they are also involved in activities that move beyond text to include

multiple literacies. Ms. Doyle designs her curriculum in a way that supports her students' abilities to use, question, and interact with a variety of media sources in order to communicate with an audience beyond the classroom. Ms. Doyle's curriculum project emphasizes a paradigm shift in literacy instruction from a reliance on alphabetic literacy to a more inclusive focus on media literacy (Honey & Tally, 2000). Using such a student-centered approach, Ms. Doyle's students are not only learning reading and writing but also developing other essential literacies. These include technological literacy, visual literacy, information literacy, and intertextuality. In the remainder of this article, we will discuss each of these new literacies in the context of the second scenario and conclude with suggestions of useful technologies to address these literacies in the classroom.

Technological literacy

Technological literacy is defined as "the ability to use computers and other technology to improve learning, productivity and performance" (U.S. Department of Education, 1997). A technologically literate person is someone who understands what technology is and how it can be used and is comfortable with its use. For students, "technological literacy goes beyond *just* knowing how to use technology tools such as word processing and the internet. It is knowing how to use them *in conjunction* with school subjects to increase academic performance" (U.S. Department of Education).

Ms. Doyle's project exemplifies this marriage between technology and content instruction. In her classroom, students begin with a curriculum project and use a variety of technologies to accomplish it. These students not only use classroom and lab computers; they also use digital cameras, video cameras, and tape recorders. In "learning center" activities, Ms. Doyle teaches small groups of students how to use the equipment and asks them to teach another group. Students then move beyond operational skills to learn how to harness these powerful tools for effective interviewing. For example, they learn how "zooming" in and out for close-ups and focusing on different angles while videotaping can facilitate what an interviewee is trying to convey. The students don't learn these technology skills in isolation but rather in

the context of a rich curriculum project aimed at developing their literacy.

Through this contextual approach of learning how to use technologies, Ms. Doyle's students are developing technological literacy. They are employing a variety of digital technologies as they are learning how to work in groups, how to express their ideas, and how to communicate with a diverse audience. These abilities are reflected in many language arts standards.

Visual literacy

Visual literacy is defined as "the ability to understand and produce visual messages" (International Visual Literacy Association, 1998). Children acquire information and develop language through multiple sources. In order to be literate in this technological age, students must learn to make meaning not only out of text but also out of the vast amount of visual information conveyed to them through images. A visually literate child can "examine, extract meaning and interpret the visual actions, objects, and symbols that he/she encounters in the environment" (International Visual Literacy Association). Being visually literate also enables a child to use these abilities to communicate with others.

Ms. Doyle's students develop an understanding of "bilingualism" through a variety of sources, which include text and images. Using their digital pictures, they discuss what they have learned from their interviews. They then arrange these pictures and, along with text, communicate this newly acquired knowledge to members of the school community and e-pals.

Information literacy

In today's world, we are bombarded with information. Information literacy is the ability to find, evaluate, analyze, and synthesize information. A teacher must help his or her students develop their abilities to use information to construct knowledge. Ms. Doyle effectively integrated information literacy into her instruction. In the process of developing their interview questions, her students used the World Wide Web to gather general information about businesses in their community. Using the websites that Ms. Doyle had preselected for age appropriateness, her students developed interview questions for community business owners. They did this by analyzing information contained in

the websites and then synthesized it into what was most relevant for their interviews. Ms. Doyle's students were becoming "effective users of ideas and information" (American Association of School Librarians, 1998).

Ms. Doyle planned her curriculum to ensure that students were engaging in developmentally appropriate activities. She helped her students by preparing information resources prior to student use. She weeded out irrelevant and developmentally inappropriate resources. Ms. Doyle also provided her students with a plan and an authentic reason for using the resources. By prescreening information resources, she ensured that her students were presented with only those that were appropriate to their ages and the task at hand. Then, she and her students viewed websites together and discussed what makes a good versus an ineffective information resource. The elements that Ms. Doyle and her students focused on were reliability or authenticity of an information source, its currency or recency, whether contact information is provided so that students have the potential to e-mail questions to information sources, and the ability to identify information as fact or opinion. In discussing these elements with her students, Ms. Doyle devised a rubric with them so that they could gauge the appropriateness of resources.

Ms. Doyle limited students' "free range" searching on the Internet to a few reliable search engines designed for young children, including Yahoo! Kids and Ask Jeeves for Kids. By encouraging students to use these "safe" search engines and apply criteria for selection of resources, Ms. Doyle was not only encouraging her students to become autonomous learners but also increasing their developmental potential.

Intertextuality

Intertextuality is a term that was first coined by Kristeva (1984) to represent the process of comprehending one text by means of a previously encountered text. Orr (1986) further elaborated on the notion of intertextuality stating, "No literary text is written in a vacuum. Besides the general culture surrounding the text and the author's own horizon (i.e., his experiences, prejudices, uses of language system, 'worldview,' and so on), there are, perhaps more importantly, other texts" (p. 814).

As the number of information sources students have access to increases, the ability to synthesize and integrate information from a variety of resources and media based on important underlying principles of a content area versus surface details becomes critical. Students must have exposure to a number of text-based resources via books, CD-ROMs, and the Internet. This allows students to begin to understand that learning resources are not isolated from one another; rather, they build on one another to help create a deeper understanding of the topic. Ms. Doyle's students encountered text from a variety of resources, including books, community business materials, and the Internet. They used these resources to develop a deeper understanding of what it means to be bilingual.

Technology played an important role in facilitating Ms. Doyle's ability to incorporate multiple literacies within her curriculum. Technology enabled the changes in classroom organizational structure, teacher and student roles, and use of resources that the paradigm shift required. Specifically, technology affords instructional methods that traditional methods do not. For example, it enables information to be presented in multiple ways. A teacher can use presentation software to introduce a new topic of study to the entire class. Then, moving into a small-group format, students can delve into key aspects of the information presented by engaging in technology-mediated research using the Internet or electronic databases.

Technology affords students nonlinear access to information. They can navigate a vast array of resources on the Internet or in electronic encyclopedias in a way that is based upon their particular interests or information needs rather than ways that are controlled by linear text formats. Electronic search engines enable students to access multiple resources on a given topic. Technology can also help students organize and synthesize information in different ways, facilitating their ability to construct and refine their knowledge. Finally, teachers can use technology to reconfigure information in a manner that is tailored to students' individual needs by using the cut, copy, paste, and highlight features of word-processing software programs.

What the paradigm shift signals for teachers

What specifically did Ms. Doyle do with her students that signals new responsibilities for teachers? She exposed her students to more than traditional texts for literacy learning. This required her to change the structure of her class so that her students could experience and use multiple literacies in the context of a rich, authentic curriculum project rather than during isolated skills instruction. Ms. Doyle chose a variety of technologies to help her students develop these multiple literacies and then folded specific technology skills instruction, such as the way to import digital pictures into a word-processing document, into the context of the curriculum.

Ms. Doyle's approach emphasizes a rich, complex use of technologies that facilitates change in the structure of the learning environment. While the project is teacher initiated, the activities underlying the unit are student centered. The arrangement of small-group activities supports the students' abilities to interact independently and learn from one another. The way in which the students interact with adults in the community provides a level of authenticity that helps the students develop lifelong literacies that will serve them well now and into the future.

This expanded vision of literacy, and the technological culture necessary to make such a vision a reality, has significant implications for teachers: It changes their roles and responsibilities. Teachers do not send their students to a computer teacher to learn how to use computers. Rather, teachers must begin to use a variety of technologies in their instruction and help students use them throughout their learning experiences. For example, in Ms. Doyle's classroom, digital and traditional cameras are used. The photos taken are easily transferred to classroom computers where they are analyzed and edited for use in e-mail communications and digital presentations. In this way, students are gaining comfort and familiarity with important tools and using them in ways that reflect their use in everyday life as opposed to their use in formalized, traditional school instruction.

This expanded vision of literacy brings a change in the quantity and quality of resources available, adding layers of new responsibilities for teachers. They must access a wider array of

resources, including technology-based tools, with the materials they evaluate for inclusion in a curriculum project. The quality of these resources is also a major issue. Technology enables teachers to widen the boundaries of their classroom to include the surrounding community as well as a global network. While this expansion has the potential to create a more authentic literacy environment for students, merely expanding opportunities does not ensure quality. For example, in an era of ubiquitous computing, most if not all teachers hunt the World Wide Web for resources, where there is little or no assurance of obtaining quality information. Anyone can post anything on the Web. Because of these changes in the quantity and quality of resources, it becomes imperative for teachers to find and evaluate technologies in a wider context that includes their curriculum, their students, and their community. They must then integrate these resources into the curriculum in a way that scaffolds the guidance their students will need to construct, represent, and communicate their knowledge.

Technologies to support the paradigm shift in literacy instruction

In a curricular space that has remained constant, how do we begin to undertake the responsibilities that address the necessary changes of technology? The vision is not manageable if we leave technology as a supplement to curriculum—we end up losing its richness and complexity, as well as the primacy of the curriculum. The way to implement the necessary classroom change is to avoid getting bogged down by technology and find existing technologies to facilitate our teaching. Technology professionals have already developed many useful tools; it becomes our role as educators to appropriate these tools in ways that nurture the paradigm shift in literacy instruction and to inform the developers of technology of the new tools we need to continue this mission.

A variety of technologies can be used to support this new vision of media literacy. Of particular support for teachers are technology tools that have been shaped into "templates." These tools are form driven, so specialized knowledge of programming languages isn't required. Because templates are easily customized and implemented,

teachers can focus on the content of the curriculum and instructional planning rather than on learning esoteric, high-tech programming skills. The following are examples of templates that can be used within literacy instruction.

Digital imaging technologies. Pictures tell a thousand words. They also support what is being communicated with words. Slide-show programs such as Microsoft PowerPoint are traditionally used to create presentations, but they can also be used in the media development process. Once students have gathered visual images from digital pictures they have taken or traditional photos they have scanned, it becomes important for them to evaluate this “portfolio” and decide what pictures should be included in a particular presentation, story, or article. Slide-show tools benefit this process because they allow students to organize photos easily in order to evaluate how a certain display of pictures communicates an idea. Some of these tools also include special effects, which offer an array of artistic enhancements and borders. Slide-show templates include the following examples:

- Slide sorter view in Microsoft PowerPoint permits the easy organization of photos. Once photos are made into slides, they can be viewed on slide sorter, and their order can be easily manipulated. This enables students to gauge the way a particular order of pictures communicates an idea.
- Kid pix slide show enables very young students to organize and manipulate digital pictures.
- Ofoto (<http://www.ofoto.com>) sponsors an online photo album feature. Students can create themed photo albums or scrapbooks to share photos with others using the World Wide Web.
- Flaming Text (<http://www.flamingtext.com>) provides teachers and students with an online point-and-click mechanism to create individualized banners, buttons, and bars to be used in a variety of multimedia projects such as newsletters and Web-based publications. For example, using this tool, students can communicate a particular message by creating images and text that convey the intended theme.

World Wide Web-based technologies. Often teachers have their students use the World Wide Web as an encyclopedia, gathering resources in ways similar to text-based sources. However, teachers can easily create Web-based files that engage students in a variety of active learning experiences. Teachers can use fill-in-the-blank forms to create these files and post them on the World Wide Web. Filamentality (<http://www.kn.pacbell.com/wired/fil>) is an interactive website that helps a teacher turn Web resources into learning activities. Included are templates for creating five different Web-based instructional designs (Dodge, 2001; March, 2001). The following are descriptions of the instructional designs and the ways in which they can be used.

- A *hotlist* is a categorized list of websites that can be used to support a curriculum unit. Teachers can “mine,” or search for and gather, websites that they want their students to explore. Once mined, Filamentality can be used to create and post the hotlist on the Web. Hotlists are an effective way to point students to Web-based resources. They can also be used to organize websites.
- A *scrapbook* enables an individual to organize Web-based media resources, such as images and sounds, and subject websites so that they can be integrated into a variety of multimedia products, including newsletters, desktop presentations, and webpages.
- A *hunt* poses a series of questions that can be answered by reading information found on key websites identified by a teacher. Once students have answered all questions, they are to respond to a larger question or concept that requires them to synthesize and analyze what they have learned. Internet hunts are an effective way for students to build their knowledge around a particular subject area.
- A *sampler* presents learners with a small number of interesting websites organized around a subject area or theme. These websites should be chosen based upon their ability to pique students’ interests and invite their speculation about the topic. Once learners have perused the identified websites, they are encouraged to share their

perspectives on the topic, share their experiences related to it, and discuss their interpretations.

- A *webquest* is a highly structured activity based upon cooperative learning strategies. For a webquest, students are presented with a challenging task and the Internet-based resources to accomplish it. Students must each adopt a role, share what they have learned based upon that role, and collaborate to create a product, such as a presentation, to share with others.
- TrackStar (<http://trackstar.hprtec.org>) helps instructors organize and annotate websites, which can then be used to shape lessons. A “track” consists of three areas. The first area contains a list of website addresses (URLs). As each URL is selected, another area describes the website, while a third area contains the actual URL link. Like hotlists (described earlier), teachers can use TrackStar to introduce students to a new topic of study. Students can also create tracks as part of a curriculum project requirement.

Webpage construction. A number of organizations host websites that allow teachers to create and post their own webpages. A teacher can use these templates to build a classroom presence on the Web. For example, many teachers use these websites to share student writing and artwork, list homework assignments, and encourage communication between home and school. The following websites offer fill-in-the-blank templates that teachers and students can use to create their own webpages. Because these created sites are given a Web address, they can be accessed via any computer that is connected to the Internet. The following webpages offer easy-to-create webpage models that are particularly useful for teachers.

- Homestead (<http://www.homestead.com>) enables teachers and students to create webpages for personal or organizational use. The personal site includes graphics libraries, design tutorials, and online support. While the professional site has many tools useful for business, it also offers individuals the ability to track who is using the website.

- Teacherweb (<http://teacherweb.com>) offers a template specifically designed for teachers and other school professionals. Teachers can create and post areas for homework, announcements, grades, calendars, links, and photos. Both Teacherweb and Homestead offer individuals the ability to create and post an unlimited number of webpages.

Global communication and collaboration. The World Wide Web gives students and teachers access to a global community. While students can accomplish the same literacy activities as they can on paper, such as creating poetry or writing fiction, the Web enables them to share this type of work with a wider authentic audience. This, in turn, positively influences their writing skills. The following websites can facilitate communication and collaboration across geographic boundaries:

- ePALS.com (<http://www.epals.com>) is labeled the “world’s largest online classroom community.” Using ePALS, teachers and students can find electronic pen pals and have the option to communicate in a variety of languages. Beyond e-mail writing, students can engage in online, themed group discussions and develop collaborative projects such as creating fiction and nonfiction books. This website offers an instant translation service, so students can communicate in their native language with individuals who may not share the same language.
- Collabo-write (<http://library.thinkquest.org/2626>) is a shared writing forum on the Internet. Using a fill-in-the-blank format, students can enter a story, add to an existing story, illustrate a story, or create a story from a variety of illustrations available on the website. Once created, all submissions appear on the Collabo-write website and can be accessed by a wide audience.

Global collaborative projects. The Internet has become a global classroom. Using technologies such as e-mail and the World Wide Web, teachers and their students can participate in curricular projects with other students and teachers from around the world. These projects offer students a variety of opportunities, including

the ability to share and compare data, solve community-based problems, and learn from experts. For example, in the Square of Life project (http://www.k12science.org/curriculum/squareproj/smallworld_starthere.html), students collect data about plants, animals, and nonliving objects found in their schoolyard environment and share the information with students in other locations. The information gathered and compared facilitates students' observation and reporting skills, develops their effective communication abilities, and enhances their understanding of geography in a way that a textbook alone cannot.

Teachers can find collaborative projects across curriculum areas by using the Internet Projects Registry (<http://gsh.lightspan.com/pr/index.html>). This service lists curriculum-based projects from a variety of organizations. Teachers can search for projects by subject area, age level, or project starting dates.

Student information searches. It is important for teachers to provide students with reference tools so that they can independently access, evaluate, and use information. The following resources provide students with tools to search safely for information and access references.

- Ask Jeeves (<http://askjeeves.com>) is a meta-search engine on the Internet. Students can search by questions, phrases, or terms. Based upon these queries, Ask Jeeves points students to information contained within multiple search engines such as AltaVista, Google, and Infoseek.
- Research Tools and Language Tools are part of the iTools website (<http://www.itools.com>), which offers students a variety of ways to research a topic in detail. These tools include dictionaries, a thesaurus, translation tools, biographical and quotation resources, maps, stock quotes, and a variety of other traditional research tools.
- When researching, students may have difficulty evaluating the authenticity of information provided within a website. Using AltaVista's search tool (<http://www.altavista.com>), students can place the prefix *link:* before a website URL to find websites that are "linked" together. This gives students the ability to see the types of

organizations that host a particular link. Knowing that other well-known organizations such as the American Library Association use a particular website as a link can increase a student's confidence that the website he or she found is a reliable source of information.

Portals. The previous resources provide a starting point and a direction for teachers as they enact a paradigm shift in literacy instruction. However, teachers must also learn how to search independently for template resources so that they may continually shape their instruction. This can be a challenging task. Technology resources are endless and searching for them can take up much of a teacher's time. One strategy is to visit regularly a few educational portals that are posted on the Web. A portal is a categorized entryway to Web-based resources. The organizations that sponsor these portals continually search for and evaluate Internet resources, including those that they have found to be beneficial for teachers and students. Therefore, a good education portal is meaningfully categorized, evaluated by educators, and updated regularly. Following are examples of reliable education portals:

- Kathy Schrock's Guide for Educators (<http://school.discovery.com/schrockguide>)
- Education Planet (<http://www.educationplanet.com>)

A broader vision of literacy

In this technological age, teachers must expand their students' technological, visual, and information literacy as well as provide them with a sense of intertextuality, or the ability to make meaning from a variety of texts. This requires teachers to reshape their curricula and enhance students' abilities to understand and use multiple technologies in order to acquire, evaluate, and organize information.

The resources described in this article enable teachers to enact a broader vision of literacy instruction within their classrooms. In this way, technology, rather than being used as an engine for instructional delivery, can be used as a mass transit system to support student-centered learning and knowledge construction.

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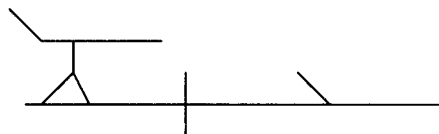
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